result in many more interesting entomological and botanical discoveries from this area.

Arg. malagrida is a good example of the manner in which the races of a butterfly species have evolved, and become isolated, in mountainous stations as a result, presumably, of unfavourable climatic changes in the lower intervening stretches of country causing the species to abandon these areas for the higher ground. Although too recent to be a contributory cause in this connection, wheatlands which now cover vast areas of the South Western Cape have certainly eliminated most of the butterflies (considered numerically) which once occurred there and were dependent on indigenous plants. Those that remain have obtained sanctuary in pockets or islands of vegetation unsuitable for cultivation.

Early stages of nominate *Arg. malagrida* recorded (in part) by Clark and Dickson in *Life Hist. S. Afr. Lyc. Butt.* (1971)

Some Aspects of the Biology of the Bark Louse *Graphopsocus cruciatus* (L.) (Psocoptera: Stenopsocidae)

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Graphopsocus cruciatus (L.) is a winged psocid which is to be found on a wide variety of trees and shrubs, mostly deciduous. I have obtained it from the following:

Commonly:	hawthorn; privet
Often:	sycamore; blackthorn
Occasionally:	alder; apple; box; cedar; ivy; holly; laurel; spiraea; yew.

The species first appears on or about the first week in April, and becomes very abundant by the middle of May. There are six nymphal stages, the adult appearing in the last week of May. The first eggs are laid in the middle of June, and continue to be laid until about the middle of July, the first eggs hatching in the first week of July. The second generation of adults matures in the last week of August, becoming abundant by the end of September. Eggs are again laid during October, November and December if the winter is mild, the adults dying in early or mid-December depending on temperature. Over-wintering adults have been recorded in the south of England but no adults were found in Uppingham after the beginning of December.

Figure 1 shows the adult of *G. cruciatus* drawn from a slide. The wings are marked with patches of various intensities of brown. The head is pale yellow, though the postclypeus may be brown. The eyes are grey to black, the thorax is yellow with brown dorsal lobes, and abdomen greeny yellow with a brown apex.

Fig. 1. *G. cruciatus* adult; left antenna and right wings and legs omitted.

THE EGGS

When first laid the eggs are a pale yellow-white; by the time of hatching they have darkened to a lemon yellow colour. They are laid in groups of up to sixteen in number, usually on dead twigs. Figure 2 shows variation in batch size in the wild, which produces a mean batch of 7.08 eggs. In November 1974 I collected a large number of adults, which laid eggs on the walls of the jars in which they were kept. Figure 3 shows variation in batch size in this captive stock, with a mean batch of 5.39 eggs. The statistically significant difference between these two sets of egg batches may be partly due to sampling error, as it is possible that some smaller egg batches were overlooked in the wild situation. It is likely therefore that figure 3 represents a situation which may well occur in the wild as well. The eggs have a mean length of 0.464 mm. and a mean breadth of 0.270 mm. Figure 4 is drawn from a photograph showing a batch of five eggs with their covering of silk.

THE NYMPHS

G. cruciatus overwinters as diapausing pronymphs within the egg shells. The time taken to hatch depends on temperature rather than season. Eggs laid in November and kept inside from the start took 28 days to hatch at 18°C. Eggs laid outside in November but not brought indoors until late January took 38 days to hatch at 15°C. Eggs from the November laying

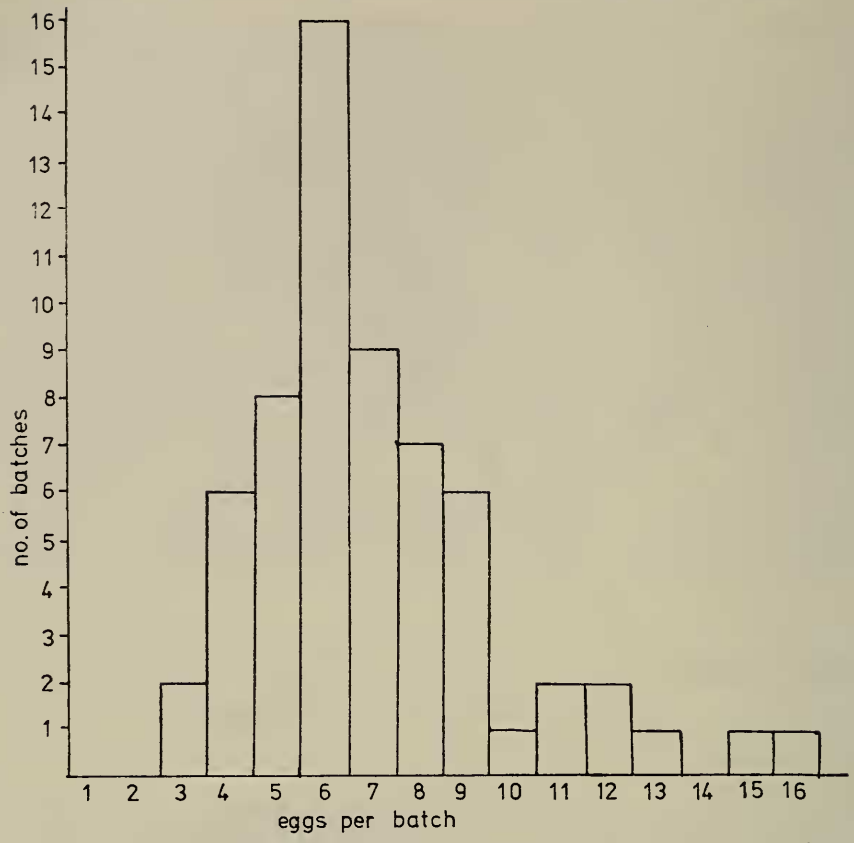

Fig. 2. Variation in egg batch size; samples collected in the wild; mean batch 7.08; 62 batches collected.

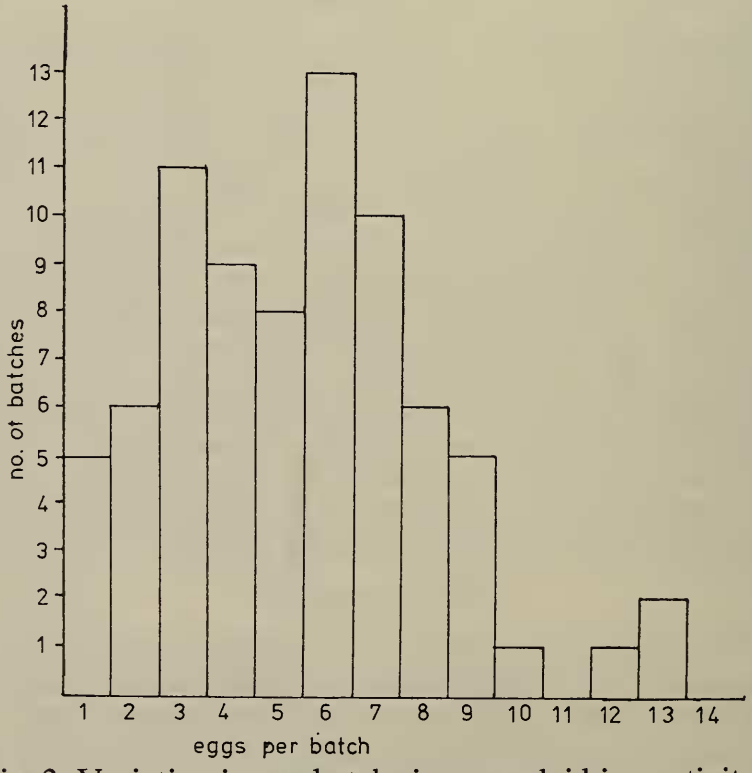

Fig. 3. Variation in egg batch size; eggs laid in captivity; mean batch 5.39; 77 batches collected.

brought indoors in February took only 5 to 6 days to hatch at 27°C.

There are six nymphal instars. The length of the nymphal phase similarly varies with temperature. My nymphs were kept at 20°C. and they took 28 days to mature, which accords well with New's data (New, 1969). The first nymphal instar differs from the subsequent five instars in having antennae with only eight segments, rather than thirteen. The body has a lemon yellow ground colour. The eyes are dark red to black. The later instars have a darker lemon yellow ground colour and develop various castaneous markings. In the sixth instar both wing pads have a broad grey transverse stripe.

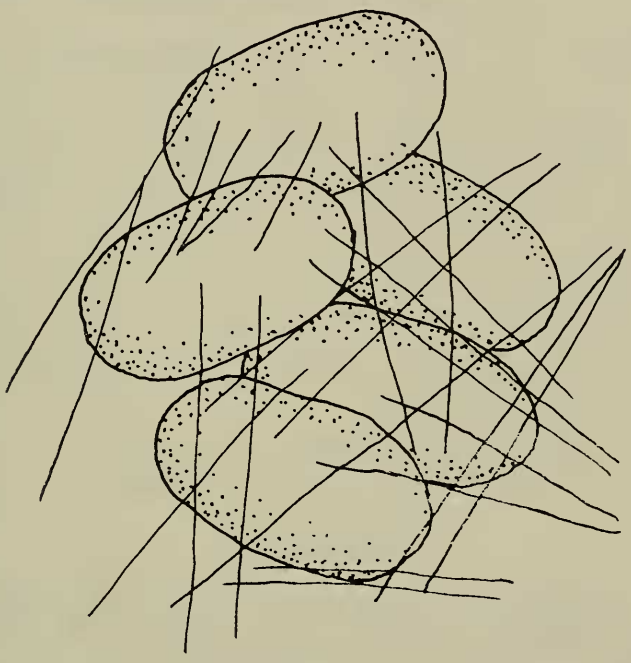

Fig. 4. Egg batch of *G. cruciatus*.

THE BEHAVIOUR OF ADULTS IN CHOICE CHAMBERS

Choice chambers were constructed from plastic petri dishes, to the design usually produced for school experiments on woodlice.

1. Atmospheric humidity choice

High humidity was maintained by moist cotton wool and low humidity by anhydrous calcium chloride below the compartments containing the insects. The results of this experiment were equivocable. Twenty psocids were used at a time, and it requires a grouping of sixteen or more in one chamber for the results to be significant at the 5% level. In the first run of the experiment such numbers occurred in the moist chamber at 9 a.m. and in the dry chamber at 5 p.m., appearing to indicate a diurnal change of preference. However, re-runs of the experiment produced significant grouping in the dry chamber only, between 9.30 p.m. and 10.30 p.m. In view of the fact that *G.*

cruciatus needs a moist atmosphere for successful rearing, this apparent preference for the dry chamber is unexplained.

2. Light intensity choice

Choice chambers of the same design were used, with one chamber completely surrounded by black paper. Under normal interior daylight conditions the preference, if any, was for the light chamber. When the illumination in the light chamber was doubled, using a lamp, there was a significant movement into the dark chamber. This may have been due to the heating effect of the lamp.

GREGARIOUS BEHAVIOUR

Individuals of *G. cruciatus* form small groups at all stages in their development, from first day nymphs to adults, and the various instars group freely together. Observations were made using a chamber divided into four regions and recording the distribution of individuals in the four regions (which did not offer any environmental differences). Groups were largest during the morning and evening (observations were not made at night), being least when the insects were most active (11 a.m. to 4 p.m.). As an example, 44 insects were introduced into the chamber. By the time that they had settled for the evening (8 p.m.) 40 of them were to be found in four groups, containing respectively 24, 8, 5 and 3 individuals.

When other species of psocid are introduced with them, *G. cruciatus* does not group with the intruders.

References

New, T. R. (1969). The early stages and life histories of some British foliage-frequenting Psocoptera, with notes on the over-wintering stages of British arboreal Psocoptera. *Trans. R. ent. Soc. Lond.*, **121**: 59-77.

New, T. R. (1974). *Handbooks for the identification of British insects,* Vol. **1**, Part 7, *Psocoptera* (Royal Entomological Society, London).

THE LARGE TORTOISHELL (NYMPHALIS POLYCHLOROS L.) IN WEST SUSSEX, 1964-72. — Considering how rare this butterfly has been in Britain during the past twenty years, the following records of my seeing it in West Sussex may be of interest. All were noted on footpaths resting with wings open. Although I made no attempt to capture them since I do not keep a collection, I was able to confirm identification in each case by a close-up view.

1964: 11.50 a.m., 19th July (one, the first I ever saw).
1968: 11.17 and 11.45 a.m., 16th April (two).
1969: 10.52 a.m., 6th April (one).
1971: 1.05 p.m., 20th April (one).
1972: 12.55 p.m., 28th April (one).

All the above were noted in the same area, but I have not seen the butterfly since. — ALISON ROSS, c/o The Editor, *The Entomologist's Record and Journal of Variation,* 14.iii.1975.